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THREE YEARS' RESULTS USING BORDEAUX MIXTURE WITH REDUCED AMOUNTS OF LIME AS A POTATO SPRAY

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The authors reported in a previous number of this Journal (1) that better yields were obtained with potatoes by spraying them with Bordeaux mixture prepared by using less lime than copper sulfate instead of equal amounts as in the usual formulae. This type of experiment has been continued for three years in three widely-separated localities. Since the results are fairly consistent under these different conditions, it may reasonably be expected that this modification of the usual practice is worthy of trial in other places.

Modifications of spraying practices have continued to give greater differences in yield at Pittsford with Rural varieties than on Long Island with Green Mountains, but otherwise similar effects have been obtained by reducing the amount of lime in the mixture.

Hydrated lime was used in preparing the Bordeaux mixtures in all experiments. At Pittsford the formulae were written in round numbers in terms of quick lime (CaO) to correspond with other experiments at the same place, while on Long Island they were written in terms of hydrated lime. Thus the mixtures were not identical in the two places. For the purpose of this conversion at Pittsford 13 pounds of hydrated lime were used as approximately equivalent to 10 pounds of stone lime as indicated in the following:

Formulae expressed in terms of stone lime CaO	Equivalent formulae in terms of hydrated lime $Ca(OH)_2$
5-7½-50	5-9.75-50
5-5-50	5-6.5-50
5-2½-50	5-3.25-50
5-1¼-50	5-1.63-50
5-0.8-50	5-1.04-50

The yields for the three years at Pittsford, table 1, have consistently shown differences in favor of mixtures containing smaller amounts of lime than copper sulfate. The yields of the treatments in the different replications also have been so uniform that all these differences are significant with the exception of the small difference between the 5-2½-50 and 5-0.8-50 in 1933. For each of the three years, decreasing the amount of lime to at least that contained in a 5-2½-50 formula has increased the yield.

The experiment for 1934 was more comprehensive than the previous ones in this series. Two different rates of applications were used, one giving a total of 60 pounds and the other 72 pounds of copper sulfate per acre during the season. Basic copper sulfate, (furnished by the Sherwin-Williams Co.), used in this experiment but not shown in the table, gave an average yield of 264 bushels per acre when used at a rate to contain copper equivalent to that in 66 pounds of copper sulfate per acre during the season. For this one experiment in which this material has been used in New York, the results are clearly inferior to those obtained with Bordeaux mixture.

The analysis of variance[1] for the yields in this experiment in 1934, table 2, is interesting. The plots sprayed with Bordeaux mixture gave highly significant increases in yield over the unsprayed plots and those sprayed with basic copper sulfate. Variations in the amount of lime in the mixtures and in the total amount of copper sulfate per acre for the season also caused highly significant differences in yield. In addition, the interaction between the amounts of lime in the mixture and the total amounts applied gave significant differences. This means that while the 72 pounds of copper sulfate per acre for the season was better on the average than 60 pounds, this did not apply to the 5-1¼-50 mixture where 60 pounds of copper sulfate per acre gave the best yields. To express it differently if the question were raised as to which formula was best, the answer would depend on whether 60 or 72 pounds of copper sulfate were to be applied. This result is such as might be anticipated from previous tests which have shown that copper is more soluble in Bordeaux mixtures containing a smaller ratio of lime to copper. Thus the mixture which allowed a larger part of the copper to come into solution would not need to be applied in such large amounts to give the same amount of soluble copper.

[1] The analysis of variance is a method devised by R. A. Fisher of separating the variability in the results of an experiment into parts due to treatments, or interactions between treatments, the variability of the blocks of treatments in different parts of a field and random variability which cannot be ascribed to specific causes. From the relative sizes of variabilities or variances attributable to these different influences, estimates can be made of the probability that the treatments have caused effects not attributable to random variations.

TABLE 1—*Yields in potato spraying experiments with different amounts of lime in the bordeaux mixture at Pittsford (by Mader).*

Year	Amt. of Copper Sulfate Applied per Acre During Season	Bordeaux Formulae											
		Unsprayed		5-7½-50*		5-5-50*		5-2½-50*		5-1½-50*		5-0.8-50*	
		Number of Plots	Yields	Number of Plots	Yields	Number of Plots	Yields	Number of Plots	Yields	Number of Plots	Yields	Number of Plots	Yields
	Pounds		Bus. per acre		Bus. per acre		Bus. per acre		Bus. per acre		Bus. per acre		Bus. per acre
1932	60	12	171.1	18	243.9	18	247.6	18	254.7			18	270.1
1933	60	12	112.6	24	206.2	24	220.2	24	238.0			24	237.1
1934	60**	12	235.5			12	279.1	12	303.0	12	317.4		
1934	72					12	298.3	12	320.9	12	311.0		

* Amounts of lime in these formulae expressed as stone lime (CaO).
** The amount of copper sulfate was varied by changing the amount of the mixture applied.

TABLE 2—*Analysis of variance for copper to lime ratio experiment at Pittsford in* 1934.

	Degrees of Freedom	Sum of Squares	Variance	Treatment / Error
Total	95	114,142.3799		
Blocks	11	33,016.2312		
Treatments	7	77,742.0424		
Error (B x T)	77	7,384.1063	95.8975	
Sprayed vs. Unsprayed	1	42,508.6579	42,508.6579	443.27**
Bordeaux vs. Basic copper sulfate	1	17,291.4571	17,291.4571	180.31**
Amounts of lime	2	9,567.0603	4,783.5302	49.88**
Amounts of copper	1	1,894.2013	1,894.2013	19.75**
Interaction amounts of lime and copper	2	2,480.6658	1,240.3329	12.93**

** Corresponds to odds greater than 100:1.

At Riverhead, five experiments involving different ratios of lime to copper have been made. Three large-scale experiments were conducted with a power sprayer and two smaller experiments with a hand sprayer. In the large-scale experiments, each plot consisted of a six-row strip, long enough to constitute 6/100 of an acre, while in the hand experiments the plots were single rows. The yields in table 3 show gains for sprayed over unsprayed in 1932 and 1933 but no gains or small losses in 1934. The main effects of spraying have been accomplished by leafhopper control. There have been no more than traces of late blight and only moderate infestations of flea beetles and early blight at any time in the experimental plots. In two of the five years at Riverhead when extremely hot dry weather killed the vines, early in the season, the sprayed plants yielded less than the unsprayed. This is to be expected under these conditions if spraying delays the enlargement of the tubers as has been found at Pittsford (3) (4).

The average gain in yield for the best mixture over the unsprayed was about 20 bushels per acre. With the gains for sprayed over unsprayed so small, the differences between mixtures could not be ex-

pected to be large and this has been the case. However, the differences, though small, have been consistently in favor of the 4-2-50 mixture as against those containing more lime. The analysis of variance appended to table 3 indicates that the odds are better than 20:1 that these small differences are significant.

TABLE 3—*Yields in potato spraying experiments with different amounts of lime in the bordeaux mixture at Riverhead (by Burke).*

Year	Bordeaux Formulae			Unsprayed	Number of Plots
	4-8-50†	4-4-50†	4-2-50†		
	Bus. per acre	Bus. per acre	Bus. per acre	Bus. per acre	
1932	231.8	225.7	235.6	197.1	8
1933	216.3	219.6	223.4	196.4	8
Hand Exp.	235.0	242.5	247.9	201.4	4
1934	242.6	246.8	249.5	257.3	8
Hand Exp.	215.0	217.1	220.8	219.2	4
Weighted Ave.	228.9	230.5	235.7	215.3	

Analysis of variance for plots sprayed with bordeaux mixture (omitting unsprayed)

	Degrees of Freedom	Sum of Squares	Variance	Treatment / Error
Total	95	28,792.9696		
Blocks	31	21,332.0029		
Amounts of lime	2	813.5365	406.7683	3.79‡
Error	62	6,647.4302	107.2166	

† Amounts of lime are expressed as hydrated lime.
‡ Corresponds to odds over 20:1.

At Sagaponack the conditions have been different. Late blight has been present and has destroyed the plants in the unsprayed plots every year except 1933 when the disease did not appear until late in the season. Good gains in yields have been obtained from spraying, the increases averaging about 50 bushels per acre over a five-year period. The most discouraging fact has been that the results have not been very consistent and there have been large differences between replications of the same treatment giving large variances and errors. The series of experiments at Sagaponack, using different ratios of lime to copper, is also not very complete as more attention has been given to other experiments particularly with Burgundy mixtures or Soda-bordeaux.

All three ratios of lime to copper were used in 1932 and 1934, and for these the yields in table 4, would indicate with odds of better than 20:1 that the 4-2-50 mixture was better. It will be noticed, however, that in the other two experiments which did not include all the mixtures, the results are inconsistent with this conclusion.

When the results for the seven experiments for which we have complete data on the Island are averaged together, table 4, there is a marked trend of increasing yields as the lime in the mixture is decreased and the analysis of variance appended indicates that the odds are better than 100:1 that this is a significant trend.

TABLE 4—*Yields in potato spraying experiments with different amounts of lime in the Bordeaux mixture at Sagaponack (by McCormack).*

Year	Bordeaux Formulae			Unsprayed	Number of Plots
	4-8-50†	4-4-50†	4-2-50†		
	Bus. per acre	Bus. per acre	Bus. per acre	Bus. per acre	
1932	263.0*	266.5	308.7	211.7	8
1933		316.7	310.4		8
1934	338.3	338.8	343.6		8
1934 Hand Exp.	366.3		318.8	335.9	4
Two yr. Ave. 1932 & 1934	300.7	302.6	326.2		
Combined averages for 3 years at Riverhead and 2 years at Sagaponack					
	252.8	254.5	265.9		

Analysis of variance for combined results of 7 experiments on Long Island.

	Degrees of Freedom	Sum of Squares	Variance	Snedecor's F value
Total	143	310,834.3775		
Blocks (including years and experiments)	47	275,612.6175		
Amounts of lime	2	4.820.4600	2410.2300	7.45**
Error	94	30,401.3000	323.4181	

* A 4-6-50 was used in 1932 instead of a 4-8-50 as given in the heading.
** Corresponds to odds of over 100:1.
† Amounts of lime expressed as hydrated lime.

SUMMARY

The results both in upstate New York with Rural potatoes and on Long Island with Green Mountains seem to consistently favor a Bordeaux mixture with less lime than copper sulfate.

In one experiment at Pittsford in which the amount applied was also varied, there seemed to be a clear indication that with a 5-1¼-50 mixture, not so much copper per acre is necessary to give maximum yields as with mixtures containing larger proportions of lime.

So far as our experience goes in these three years in the three localities, it appears safe and desirable to reduce the lime in the mixture, either stone or hydrated, at least to half as much as the amount of copper sulfate.

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FERTILIZER PLACEMENT STUDIES WITH POTATOES IN 1934

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Fertilizer placement experiments to determine the best methods of applying fertilizer for potatoes were begun in 1931 in New Jersey on Sassafras loam; in Michigan on Montcalm sandy loam; and in Ohio on Canfield silt loam. Since then the studies have been expanded, until, in 1934, fertilizer placement comparisons were in progress on prominent soil types in Maine, Michigan, New Jersey, New York, Ohio and Virginia. This experimental work is being conducted cooperatively by the respective Agricultural Experiment Stations (1), the Bureaus of Agricultural Engineering and Plant Industry, U. S. Department of Agriculture, and the Joint Committee on Fertilizer Application (2). The work with potatoes in 1934 involved a comparison of six methods of fertilizer placement at all locations. In some experiments additional methods were included. The methods of placement and information as to soil type, variety grown, fertilizer analysis, and rate of application are given in table 1.

The study of machine application of fertilizer for potatoes was made with a special machine equipped with suitable attachments for accurately controlling the rate and placement of fertilizer. Since the same machine was used at all locations, the mechanical conditions

1. In Virginia, the fertilizer placement studies were conducted in coöperation with the Virginia Truck Experiment Station.

2. Membership made up of representatives from the National Fertilizer Association, the American Society of Agricultural Engineers, the National Association of Farm Equipment Manufacturers, the American Society of Agronomy and the American Horticultural Society. Reports covering coöperative fertilizer placement studies made in 1934 were presented to the Joint Committee on Fertilizer Application at its 10th Annual Meeting, held in Washington, D. C., November 21, 1934, which included those of Experiment Station coöperators. These reports will be published in the Proceedings of the Joint Committee and elsewhere as a general report on the subject.

relating to planting and fertilizer distribution were practically uniform throughout.

The results of the fertilizer placement studies in 1934, (Table 1) are summarized as follows:

In Maine, on Caribou loam, side placement of fertilizer, 4-8-7 analysis, proved decidedly superior to furrow placement, whether in the furrow mixed with the soil or in a band. For the same comparison fertilizer applied in a band 2 inches to each side, on a level with the seed piece yielded 582 bushels per acre or 146 bushels more than the placement well mixed around the seed piece. A reduction of 89 bushels was obtained where the fertilizer was placed in a band 1 inch under the seed piece. Considering the side placements as a group, fertilizer on a level with the seed piece was more effective than that 2" below the seed piece level. Side placements on seed level, both 1 inch and 4 inches away gave yields 67 and 57 bushels per acre less, respectively, than the side placement 2 inches away. The average of the 4 side placements was 530 bushels and of the 2 furrow placements 465 bushels per acre.

In New Jersey, on Sassafras loam, the highest yields were produced with side placement of the fertilizer. The average yield for the 4 side placements was 205 bushels and for the 2 furrow placements 179 bushels per acre. The yields from the side placements did not differ widely among themselves and therefore might be considered of equal rank. Where fertilizer was applied in a band under the seed piece, the average yield was 30 bushels less than the average yield for the side placements with 10 replications in each case. Mixing of the fertilizer with the soil around the seed piece resulted in a reduction of 23 bushels per acre compared to the side placements.

In Ohio, on Chenango silt loam, there was some indication that the side placement of the fertilizer gave better results than the furrow or row applications.

In Michigan, on Montcalm sandy loam, the side placement of fertilizer, 4 inches from and on the same level with the seed piece, gave the highest acre yield 280 bushels. However, at the relatively low rate of fertilizer application, 800 pounds per acre of a 4-12-8 mixture, some of the furrow or row placements were not significantly inferior to the side placement. The side placement 2 inches from the seed piece on the same plane should doubtless be considered equal in rank to the 4 inch distance. Mixing the fertilizer with the soil around the seed piece appears to be definitely inferior, yielding 43 bushels per acre less than the best side placement. Lightly mixing

the fertilizer with the soil above the seed piece, resulted in much less contact of fertilizer and seed, and was equal to the side placement. Considering the side placements as a group, the 1 inch distance was least desirable and the placement on a level 2 inches below that of the seed was less effective than on the seed level, although the yield differences in these cases were comparatively slight.

On Mancelona gravelly sandy loam in Michigan, with relatively low rates of fertilizer application, trends among placements are not distinctly defined. The side placement 1 inch from the seed piece and on the same level gave the highest yield. Mixing of the fertilizer with the soil in the row was among the placements of lowest rank. Among the group of side placements the one 2 inches below seed level gave a substantial reduction in yield compared to those on a level with the seed piece.

On Long Island, on Sassafras sandy loam, the four side placement methods gave an average yield of 207 bushels per acre and the two furrow placements, a band underneath, and well mixed with the soil around the seed piece, gave an average yield of 192 bushels. It was found, however, that fertilizer lightly mixed with the soil over the seed piece gave the highest yield in this experiment. With the fertilizer well mixed around the seed piece, thus bringing considerable fertilizer in contact with the seed piece, the lowest yield was obtained.

In Virginia, on Sassafras sandy loam, it was found that side placement generally gave the best results. The four side placements, those having the fertilizer on a level with and on each side the seed piece, 1, 2, and 4 inches away and the placement 2 inches to each side and 2 inches below seed piece level, gave an average yield of 311 bushels per acre, while the three furrow placements, one a band underneath, the other two, fertilizer well mixed with the soil around and lightly mixed above, gave an average yield of 247 bushels, a difference of 64 bushels in favor of the side placements. Of the side placements, the one on a level 2 inches below that of the seed was the least effective. Mixing of the fertilizer with the soil around the seed piece gave the lowest yield which was 96 bushels less than the highest yield obtained from placement of the fertilizer 4 inches from and level with the seed piece.

Summing up the results for 1934 as a whole, it is evident that in general side placement of fertilizer gave higher yields than fertilizer applied either under or over the seed piece whether mixed with the soil or in bands. Without exception the side placement on a level with the seed gave higher yields than the comparable side placement

TABLE 1—*Yield results of fertilizer placement experiments with potatoes—1934—conducted coöperatively in Maine, Michigan, New Jersey, New York, Ohio, and Virginia.*

Results Stated in Bushels per Acre (Total Yield)

Placement No.	Method of Fertilizer Placement	Maine (Caribou Loam)	Michigan (Montcalm Sandy Loam)	Michigan (Mancelona Gr. S. Loam)	New Jersey (Sassafras Loam)	New York (Sassafras Sandy Loam)	Ohio (Chenango Silt Loam)	Virginia (Sassasfras Sandy Loam)	Average for All Locations
1	In furrow, lightly mixed with soil over seed piece	Bus. ...	Bus. 278	Bus. 256	Bus. ...	Bus. 228	Bus. 144	Bus. 263	Bus. ...
2	In furrow, well mixed with soil around seed piece....	436	237	260	182	188	149	232	240
3	Side placement, in bands, 2" from seed piece, same level	582	274	270	201	212	166	307	289
4	2" on side and 2" below seed piece, in bands.....	499	267	246	199	200	155	291	265
5	4" on side, in bands, on level with seed piece....	525	280	259	209	197	155	328	282
6	1" on side, in bands, on level with seed piece.	515	256	281	200	218	162	318	279
7	In furrow, in 4-5" band, 1" of fertilizer-free soil between seed piece and fertilizer band	493	270	271	175	197	156	248	258
	No fertilizer	341	239	188	...	...	156	57	...
	Range in yield among placements	146	43	35	34	40	22	96	...
	Variety grown	Green Mt.	R. Russet	R. Russet	Cobbler	Green Mt.	R. Russet	Cobbler	...
	Fertilizer analysis	4[1]-8-7	4[1]-12-8	4[1]-12-8	4[1]-8-7	4[1]-8-7	4[1]-10-6	6[1]-6-5	...
	Rate per acre (lbs.)	2000	800	800	2000	2000	1500	2000	...

1—Nitrogen basis.

Note—Placement method No. 1, "In furrow, lightly mixed with soil," placed the fertilizer largely over the potato seed piece in a cross sectional area of approximately 3x3 inches. Contact of some of the fertilizer with seed piece resulted.

2 inches below seed level. Mixing of the fertilizer with the soil around the seed piece was consistently the poorest placement. The 1934 results substantiate the findings of previous studies covering a period of three years.

POTATO CONTROL

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In the past ten years the potato production in the United States has struggled through changing economic conditions affecting materially cost of production, both up and down. This period marks the culmination of improvements in cultural, technological, and biological methods that have been most valuable and gratifying. There has been much attention devoted to developments of cooperatives and changes in marketing methods and many plans have been suggested and a number have been tried.

There is one outstanding fact discernible throughout the period and it is that the larger the crop, the less total money received by the producer. This fact stands out over and above any other thing that the last ten years has taught us and it probably suggests the solution of the problem of the potato producer.

The facts are that when the total potato crop in the United States was 358 million bushels or larger, the entire moneys received by the producer was less than the cost of seed, planting, cultivating and harvesting with nothing left for rent, water, labor or cost of living.

In five of the last ten years, the crop was greater than 358 million bushels and the producer received less than out-of-pocket cost. In three of the remaining five years, the crop was small enough to warrant fair prices but adverse economic conditions prevented a living price to the producer. In the other two years, or two out of ten, the price of potatoes was high enough to make a profit for most producers but not enough to produce a favorable average over the entire period.

However, total figures and averages may be misleading and lead to an incorrect conclusion. A review of the conditions in a specific area may be helpful towards getting the true picture. The State of Maine has been selected because it is the outstanding potato producing area

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(Read at the annual meeting of the Potato Association of America, held at Pittsburgh, Pa., on December 28th, 1934).

of the United States. Aroostook County, producing most of the potatoes grown in Maine, has soil and climate that is particularly adapted to potato raising. Improvements in seed, use of fertilizer and spraying have enabled this county to produce yearly approximately three times the United States average of bushels per acre. This area is not unduly far from market and is much nearer to large concentrated consumptive markets than its nearest competitor quantitatively—the State of Idaho.

Let us examine what the last ten years have done for this natural garden spot for the raising of potatoes. Seven out of the last ten years show the Maine potato producer with a loss of out-of-pocket money. Three of the ten have been profitable. The Maine farmer, with all the natural God-given advantages and the best cultural methods, is just better one year out of ten than the rest of the potato farmers of the United States.

To get a picture of the financial conditions of a large part of Maine's potato farmers, it is not necessary to resort to statistics but merely to review the extent of federal money that was poured into Maine last spring to enable farmers to buy seed and plant the crop now being marketed. This flood of federal money undoubtedly led to the increase of acreage planted, which has increased the delinquency of the Maine farmer this year and leaves federal assets in Maine badly involved.

If the Maine farmer can't raise potatoes profitably what chance has the potato farmer in other areas of our country? The potato is a strictly national crop. There are almost no imports or exports—it is grown in every state and is a commercial crop in 36 states. There are over three million potato farmers in the United States. The problems of the potato producer are important to the people of the United States and these problems have been given a great deal of thought and attention by the Federal Department of Agriculture, the A. A. A., and the State College and Experiment Station authorities. Many attempts have been made by attacking the problem sectionally, but have failed because the real trouble is national. There may be many localized problems that should be solved and there may be other problems of a national scope that need solution but the last ten years clearly show that there is one definite factor affecting Maine or California—Washington or Florida—good farmer or poor farmer—heavy producer or poor producer, and it is that too many potatoes mean prices below the cost of living.

The raising of too many potatoes so that a fair price to consumer and producer cannot be realized, affects every man, woman and child

directly connected with potato raising. It affects every person living in regions where potatoes are an important crop. It reaches the depths of our economic well-being by lessening the resources of the industrial and transportation classes depending on agricultural purchases.

It is clearly shown that a balance between the amount the consumer can purchase and the amount offered for sale to the consumer will be productive of a fair price to each. The need of this balance is universal to every potato farmer in the United States. Other things may be necessary to all, and other things may be necessary to some, but the balance is necessary to all potato producers.

A balance between the amount offered for sale and the amount that the consumer can purchase, will solve the potato problem of the United States. If the quantity moving to market is just about equal to the consumptive demand, a fair price to both consumer and producer will be maintained. At first glance this seems to be an impossible thing to do and if it could be done, it would entail such a complex organization that it would be too expensive. A thousand arguments can be presented against the principle but all of them fail if the matter is fully thought out.

In the past the major difficulty in the potato industry has been the thought that any improvement must be made at the expense of some other area and for the benefit of the group making the proposal. If the problem is defined as one where the total quantity made available for sale and the rate at which it moves is made to balance the existing consumptive demand, then the complication of jealousy is abated.

Probably the easiest method to visualize a type of solution fitted to the Potato Problem is to examine the California Agricultural Pro Rata Act. Following are extracts from a paper read by H. E. Erdman of the Giannini Foundation of the University of California, at a meeting of the Western Farm Economics Association, Berkeley, California, June 22nd, 1934:

"Through the period of half a century, many groups of California producers have faced chronic conditions of overproduction in the sense that at almost any time there were excess acreages in many crops, . . . But if production was increasing more rapidly than demand, such shipments invariably meant a loss to the producers since markets were being crowded beyond their capacity to absorb at prices satisfactory to producers. A characteristic of the market for perishables produced at a distance from the point of consumption is violent price fluctuations. Thus, although a bumper crop may reduce wholesale prices in New York or Chicago, only 30 per cent, prices f.o.b. California may fall 66 per cent and producers' net returns may actually vanish. . . .

Out of the recognition that cooperative marketing cannot accomplish the desired control, came the so-called clearing house movement, an elaboration of the cooperative idea for the inclusion of shippers and packers. These movements were to be industry-wide. Some did and some did not include provisions for surplus control although the motivation back of most of these movements was the desire for control. Usually it was the naive notion that merely holding for a price would get the desired result.

In recent years there have been a number of attempts for surplus control by the disposition of part of the crop. Among these were the Sun-Maid Raisin Growers' attempt to manufacture surplus raisins into syrup, the plan followed by the California Fruit Growers' Exchange for the manufacture of surplus lemons into by-products, and the cling peach and grape plans of allowing part of the crop to remain in the field. Each of these plans brought into clear relief the advantageous position of the non-cooperator.

The question was rapidly raised as to why a small minority should be permitted to do in the marketing field what it would never be permitted to do in such a program as road building or public school building; namely, refuse to participate and in fact benefit by refusing to cooperate. Finally, two requests were made to the University that the whole problem be studied. Dr. E. A. Stokdyk was assigned to the job and early in 1933 prepared a report entitled "Economic and Legal Aspects of Compulsory Proration in Agricultural Marketing." Publication of this report and in the ensuing discussion of the suggested law led to its enactment by the California Legislature early in the season of 1933.

What the Act Provides

The Act provides for restriction of marketing of a specified crop in any given area when two-thirds of the farmers, controlling two-thirds of the acreage involved are in favor of control and provided, further, the prorata commission approves thereto. The Act is distinctly different from compulsory cooperative schemes in that both private and cooperative marketing agencies are free to operate as they please except as to quantity shipped.

Proration Activities under the Act Thus Far

The first instance of actual proration under the Pro Rata Act was inaugurated for the Imperial Valley lettuce crop. The program ap-

proved by the Commission provided that there might be a complete shut-down and this was the policy adopted in order to clear the eastern markets of cars that had accumulated on railroad tracks. An interesting problem of enforcement immediately arose and one of the shippers announced that he would continue to ship in spite of the shut-down order. Upon the authority of the Commission, the program committee went to the Superior Court of Imperial County and obtained a temporary restraining order prohibiting the particular shipper and several others, including the two railway companies from violating the proration program, and ordering them to show cause at a later date why the temporary order should not be made permanent.

The order was granted on the 22nd of January and on March 1st and 2nd, after a hearing, was made permanent. This was the first test as to the constitutionality of the Act. During the rest of the program, curtailment ran as high as 70 per cent. The unusual heavy curtailment program became necessary because, while Imperial Valley weather conditions were unusually favorable for production, the East was suffering from a severe blizzard so that market demand was extremely slack, a most unusual coincidence, well illustrating the type of situation for which a proration program offers a remedy.

In addition to the lettuce prorate plan in the Imperial Valley, prorate plans were later adopted in the Santa Barbara and San Luis Obispo counties' lettuce producing regions, in the Kern County potato shipping region, in the Gravenstein apple district in the Sebastopol-Santa Rosa regions, and in the Concord grapes produced in Santa Barbara, Ventura, Los Angeles and Orange.

What May Be Expected of the Prorate Act

The Prorate Act promises a solution for the sort of problems involved where special crops are produced in concentrated areas and shipped to distant markets. In nearly every instance there are wide variations from year to year in total production, wide variation in market demands, and frequently peaks in rate of shipment when markets become badly demoralized. Such situations can be handled under the Prorate Act and burden of control shared equally by all members of the group. Consumers are of course interested in the question as to whether they are to be over-charged. Presumably, they have protection in that certain members of the Prorate Commission are not producers and are supposedly selected to represent consumers. They likewise have protection in that producers have volume to sell and in most cases can market fairly substantial volumes at low prices more profit-

ably than they can sell a small volume at high prices. There are therefore limits to even short-time exploitation of the consumer. The long-time question concerns the extent at which production will be increased if prices are maintained at unduly profitable levels. If such a procedure remains permanently available to California producers or to those of other states, the policy will very definitely have to be one of establishing prices at such a point as not to increase production by making controlled crops unduly profitable compared with other crops or products, either in the state concerned or in other states. A controlled price so low that it does not bring forth increased supplies cannot be considered inimical to consumers.

The experience with surplus control elsewhere is that producers are likely to over-emphasize the so-called "sunk costs," that is, their overhead in particular situations. They commonly fail to recognize the fact that they must meet the competition of producers in new sections, operating on cheap land or those anywhere adopting improved varieties, improved methods or machine production with large-scale operations, etc.

Certificate Plan for Surplus Control

The certificate plan for surplus control provided by the act eliminates the question of quality, providing the certificates are freely interchangeable. Assume, for example, that a producer of lettuce finds that his quality is running low, whereas another finds that his quality is running high. Each, let us say, has certificates covering 80 per cent of his crop. One has shipped 80 per cent of his crop and still has another 10 per cent of high-quality stuff suitable for shipment. The other has shipped 70 per cent of his crop and has no more high quality stuff available but has certificates to cover another 10 per cent. The man with the superior quality could very easily afford to buy for a few cents a package, the certificates of the producer with poor quality stuff. Normally, this poor stuff would be shipped even if it were to bring back only 10c a package. The man with the better supply might however, be willing and able to pay 20c and still make an additional profit.

A free exchange of certificates was opposed by some of the producers and others in some of the recent discussions on the ground that a man who had certificates for sale had been granted too large an allotment, that he must have reported his crop at too high a figure, etc. This, of course, gets back to the basis of proration and to such questions as to the treatment to be accorded to the man whose crop was

partially destroyed by frost, hail, or other damage. It should be clear, for example, that if the appraisal is made at the beginning of a season it may be widely in error either because of purposeful over-estimation, erroneous over-estimation, or over-estimation because between the time of the estimation and the time of harvesting, insect pests, disease, or drought have decreased the yield. There is a possibility of including in the certificate plan of proration an element of crop insurance. This would be the case, for example, if the crops were estimated on the basis, let us say, of the past three years' average production.

The control of surpluses by prorating involves a mixture of problems. Perhaps the more important concern the jobs of determining (1) how much to market at any one time (2) how to appraise specific fields, and (3) how to allocate shipping rights. Space does not permit their discussion in this paper. An error in the first may be serious even if the divergent points of view were not involved. Errors or bungling administration of the others may lead to failure of otherwise good plans by setting up too much irritation of liberty-loving human beings. The problem is far from simple. In addition to the above points it needs even more careful consideration from the point of view of farm practices resulting from the adoption of alternative plans, no plans, or uncertainty as to what plans are likely to be used."

The cost and beneficial results of the prorate programs are covered in the following abstracts from a release of Edson Abel, Secretary of the California Agricultural Prorate Commission:

"A short summary of the results obtained by the managing committees in each of these programs will serve to indicate the degree of success which has characterized their operation. Growers of lettuce in the Imperial Valley are $500,000 better off than they would have been without the marketing control instituted under the Agricultural Prorate Act. All of this benefit cost them approximately $8,000. The Gravenstein apple producers of Sonoma and Napa Counties, faced with a 40 per cent crop because of pests and climatic adversities, nevertheless put their control machinery into operation to see how it worked. It was very successful and the ground work for 1935 has been well laid.

The lettuce growers of San Luis Obispo and Santa Barbara Counties are still operating under their program in the fifth month since its inauguration. They are moving about 100,000 crates per month, somewhat in excess of last year's marketings. Their average returns have improved from 25c to 50c per crate over those of 1933. The cost of the program has been less than $1000.00 per month. An

increase in returns of from $125,000 to $250,000 at an outlay of less than $5000.00 is distinctly worthwhile.

The growers of Irish potatoes in Kern County, urged on by weakening price for their commodity, applied to the Agricultural Pro Rata Commission for a program. It was instituted, and it appears that its mere inauguration, giving the program committee of five growers and two handlers the power to regulate all shipments of potatoes in the interest of fair prices to producers, was all that was needed to stabilize the prices and discourage any schemes for price manipulation that were under consideration. Kern County potato growers received something in excess of their cost of production this year for the crop from an average which had increased from 4500 to 6800. In fact, so satisfied are they that it is probable that the acreage will take another jump next year.

The Concord Grape growers of Santa Barbara, Ventura, Los Angeles and Orange Counties were faced with a crop of twice the size of that of 1933. Prices in 1933 were not satisfactory and the tremendous increase in volume would, if placed on the market in a haphazard manner, undoubtedly have forced prices to ruinous levels. A program was made effective on the petition of two-thirds of the growers and the marketings of 1933 were doubled in 1934 at slightly better than 1933 prices.

The sixth program now in effect covers artichokes from the central coastal counties. The experiences of the last two years have driven the artichoke growers to desperation and now they are resorting to the Agricultural Pro Rata Act to bring their marketings under control in order to gain a living return from their farming efforts.

The seventh, eighth and ninth programs are now on the list of possibilities. The first of these is proposed on tomatoes from seven southern counties. The eighth and ninth may be on sweet potatoes; in one instance on those grown in Riverside, San Bernardino, Los Angeles and Kern Counties, and in the other on those produced in Merced, Stanislaus and San Joaquin Counties. The hearing on the tomato petition was held in Los Angeles on October 9th and the sweet potato petitions will have their days in court soon.

As is evidenced by the recitation of the experiences under the Agricultural Prorate Act, it is a very practicable method of bringing order out of the marketing chaos often found in connection with agricultural products. It is an effective weapon against the individual greed and selfishness which is largely responsible for the havoc in prices for agricultural products, yet it is welcomed by a great majority of the

growers who have experienced its operation. Apparently they have not been greatly concerned over the slight restraint put upon them so long as their neighbors were likewise curbed to prevent marketing excesses.

None of the programs now in effect has resulted in any injury to the consuming public. In the first place, the consumers are perfectly willing to see the producers obtain a living return from their efforts. This may not be true of certain handlers who find that restriction in marketings runs contrary to their own self-interest, but the consumers themselves do not follow the lead of this group. In the second place, the comparatively small increase in prices to the producers, which makes all the difference in the world to them, is hardly noticeable to the consumers.

Many handlers, too, favor the control of marketing afforded by operation under the Agricultural Prorate Act. It results in stabilizing their business and removes a large part of the element of speculation, the existence of which gives them a feeling of insecurity which they would just as soon not have."

The foregoing description of the California Agricultural Prorate Act has been presented to show a legal type of machinery capable of regulating the flow and total quantity of highly perishable agricultural commodities moving to market. None of these commodities is less perishable than potatoes and most of them are infinitely more perishable. It is not suggested that the prorate plan will fit all the requirements of the potato industry but it certainly does suggest a pattern from which a national plan for potatoes could be built. The first rough paths have been cut in the jungle of marketing perishable agricultural products—the way to successful control is becoming clearer.

It may be interesting to guess what the potato situation in the United States would have been at the time this paper is written if Maine had a pro rata act applying to potatoes.

Present Situation

In Maine the price to farmers is lower than in any other spot in the whole country. The farmers in Maine are receiving approximately 30 cents a cwt., or 18 cents a bushel. In Idaho, farmers are paid 50 cents a cwt., or 30 cents a bushel. Prices in intervening states are higher than Maine although the nearness to Maine scales down the price a little. Maine has a probable surplus of 15 million bushels in estimated bushels produced, or approximately 15,000 shipable cars. The weight of this supply is depressing the price in Maine. Maine is seeking outlets in all possible markets, many of which are ill-advised.

The competition of these Maine potatoes in markets which are usually supplied from other states, lowers the price of all potatoes, irrespective of where they are grown. Thus Maine is not only lowering the prices on itself but is likewise depressing the price of potatoes all over the United States.

The actual movement to date for Maine is practically no greater this year than last year so it is not the quantity that has moved or is moving to market that is causing the harm. The crux of the situation is that the normal attitude of the farmer and the dealer in Maine and the purchaser of Maine potatoes in all markets is that there are too many potatoes in Maine and therefore the price must be low. There are no factors present that are sufficiently powerful to overcome the adverse psychology resulting from an almost unmarketable surplus.

What the Situation in Maine Might Be

Let us suppose that Maine had an agricultural prorate act similar to the California law and that the Commission met to analyze the situation. In rough they would find that the states west of the Mississippi were considerably short of potatoes as compared with last year. The government says these states have 17 million bushels less than last year. The Commission would find that the quality in Idaho was very poor and that there were very few potatoes in Idaho good enough to make No. 1 grade.

The Commission, on investigation, would find the prolific Red River Valley of Minnesota and North Dakota decidedly short of last year. The Commission would quickly decide that there was little competition to fear from these districts. In Wisconsin they would find that most of the increased production this year over last year had already been marketed and would therefore be no factor in the situation.

The picture quickly narrows down to the quantity of potatoes in Michigan, Maine, New York and Pennsylvania. Based on the government estimate, it would appear that the surplus in these states over last year amounts to approximately 47 million bushels. To this should be added surplus in the deficiency-producing states amounting to about 8 million bushels. The total surplus is therefore about 55 million bushels. The Commission would decide that it would be entirely in order to subtract from this total the deficiency in the west, which would leave a net surplus of about 38 million bushels without allowing anything for the actual shortage in Minnesota and North Dakota.

The Commission would probably decide that about 30 million bushels would have to be removed from possible movement to market in order to approximate the price of last year. Needless to say, the Commission would have anticipated the possibilities of this situation and would have done everything possible to get their neighbors in other potato states to assume part of the surplus. In this they would probably have received help from the other states, but suppose that Maine were acting alone and that the Commission had decided that Maine should remove from the market 30 million bushels of potatoes, leaving Maine only 27 million bushels to market. This figure for Maine would bring the surplus down so low that prices in Maine would be at least 60 cents a bushel and probably closer to $1.00 a bushel.

In 1933, Maine prices averaged close to 60 cents a bushel and in 1930 the average was 64 cents a bushel. Let us assume that the price would be 60 cents a bushel and note the results. Under present conditions, Maine will market 62 per cent of a 57 million bushel crop or approximately 36 million bushels, which equals 60,000 shipped cars. These 36 million bushels will sell at 18 cents per bushel, realizing for the Maine farmer about $6,480,000.

Under the prorate plan, Maine would sell 27 million bushels or 45,000 cars at 60 cents a bushel, receiving approximately $16,200,000. Thus the farmers of Maine would already be $10,000,000 better off but this is not all. Maine would have at least 10 million bushels of potatoes suitable for food which the Federal Government would purchase for relief at, at the least, 20 cents a bushel. This produces another $2,000,000 accruing to the farmers of Maine and there probably would not be any competition for this government business on the part of other states for the reason that, under this setup, potatoes in other states would be worth at least 60 cents a bushel and Maine would have the government portion all to itself; but even if there were competition for sale to the government, and other states insisted on meeting Maine's price of 20 cents a bushel, the ultimate effect on distribution would be to increase Maine's pro rata release for market purposes which would increase Maine's total revenue.

Of course, it is rather fantastic to plan that any one state would have to assume all the burdens of proration but it is very interesting that the set-up this year is such that the State of Maine, with the use of a prorate plan, could sell all the potatoes that were produced at, at least $12,000,000 more than they will get under the

present plan, and the starving people of the United States would be amply supplied with potatoes throughout the entire year at somewhat less cost to the government than these relief potatoes are now costing the relief agencies.

Simultaneously with this marked improvement in the financial situation of the Maine farmer, there would flow increased revenue to potato farmers all over the United States with the result that their buying power would be materially increased and one more step would be realized in the difficult climb towards a better balanced economy.

It must be remembered that even though a state has a prorate law, there is no obligation to use it in the limiting of movement to market when it would be of no advantage. In 1929 Maine produced 50 million bushels of potatoes and sold 61,000 cars at an average price of at least $1.20 a bushel. Under a condition of this sort, there would be no reason to even contemplate restricting shipments. Likewise it must be quite apparent that if the use of a pro rate plan were adopted by quite a number of states, it would be a rather simple matter for the Commissions of the various states possessing prorate laws, to hold a conference to the effect that a distribution of the surplus could be divided among several states instead of one. If the distribution of surplus were spread among a number of states, it is almost impossible to conceive of a year in which the pro rata curtailment would be anything greater than 10 per cent of the production. The facts of the case are, that under any reasonable spread of a pro rata restriction, the non-sale of a portion of the No. 2 potatoes that are now marketed, would be sufficient to take care of the surplus. These No. 2 potatoes are sold at such a price that they add very little to the income of the producer but materially depress the prices at which all potatoes sell.

A widespread or a national pro rata distribution would, with the elimination of the No. 2's, be about all the restrictions that would be necessary in order to obtain a balance between the amount used and the amount offered for use. The solution of the potato problem is quite a simple one.

YELLOW-FLESHED POTATOES

F. J. Stevenson

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Within recent years considerable interest has been shown in potato varieties with yellow flesh. In Europe, especially in Germany, yellow-fleshed varieties have been distributed to commercial growers. As a result of the reports of the good quality of some of these varieties, inquiries concerning them have been received by the United States Department of Agriculture.

This Department has brought in, from foreign countries, from time to time a number of yellow-fleshed varieties. In the collection of varieties and species made in South America by the Division of Plant Exploration and Introduction, many yellow-fleshed sorts were found. Several have been introduced from Europe and are now under observation. Some of the best German varieties which have been grown are Goldappel, Goldadler, Ackersegen, Industrie, Ovalgelb, and Dauerregis. Several of the introductions may possess characters which will be valuable if they can be combined with the more desirable characters of the American commercial varieties, but none of them are suitable for distribution.

Ackersegen, for example, may be valuable for breeding, since it is reported to be resistant to wart, common scab and late blight. It has shown resistance to late blight in the tests at Presque Isle, Maine, and is apparently somewhat resistant to scab. From the commercial standpoint, however, Golden, one of the new yellow-fleshed varieties of the United States Department of Agriculture, surpasses all foreign introductions in shape, market quality and yield. Golden has very good cooking quality when grown at Presque Isle, Maine, and has fairly good shape with medium shallow eyes. It yielded 505 bushels per acre for an average of 4 years in comparison with 392 bushels for Green Mountain. Golden is not very widely adapted as indicated by rather limited tests. It yields exceedingly well in the Maine tests and favorable reports have been obtained from northern Michigan.

Other yellow-fleshed varieties are under test and it is quite certain that before long many of these varieties will be available to supply whatever demands there may be for this sort of potato.

THE PRICE SITUATION

The following report on potatoes was released on July 15 by the Bureau of Agricultural Economics of the United States Department of Agriculture: Potato prices advanced sharply during the first week of July from the extremely low point of late June, but they were not yet back to the level of a month ago. Supplies of old stock were still liberal for this time of the year, but new potatoes were less plentiful than in 1934. Conditions as of July 1 indicate a total United States potato crop as of 368,000,000 bushels, or nearly 5 per cent less than last year's harvested crop but about 1 per cent above the average for 1928-1932. While the final out-turn of the crop will depend upon growing conditions between now and harvest time, present prospect indicates that potato prices this season will average slightly higher than during the marketing year just closing.

During early July, Eastern Shore Cobblers advanced in the New York market to $1.44 per 100 pounds from $1.05 in late June, and Maine Green Mountains were slightly stronger at 78 cents. A month earlier, new potatoes averaged $1.56 and old stock 72 cents in New York. The price of new stock was about 25 cents per 100 pounds higher than a year ago, at which time shipments were much heavier than during early July 1935. The f.o.b. price of Cobblers on the Eastern Shore of Virginia recently reached a range of $2.00—$2.10 per barrel, after having been as low as $1.40, while 100 pound sacks reached $1.25, compared with 85 cents during the low price period of late June. A year ago, shippers on the Eastern Shore were receiving 84 cents per sack or $1.40 per barrel. Prices of Bliss Triumphs in the Chicago car-lot market during the first week of July averaged $1.55 per 100-pound sack, or considerably below the level of early June, while a few sales of northern old stock were still made at 40 cents. At the same time last year, new potatoes averaged $1.55 in Chicago.

The total potato crop in Virginia is forecast at 11,000,000 bushels, or 17 per cent less than last season and 23 per cent below average. New Jersey's total production is expected to be about the same as in 1934. Seven intermediate states together have prospects of 37,000,000 bushels, a considerable increase over last year, chiefly because of larger crops in Kentucky, Missouri and Kansas. All of the increase this year is expected to occur in the non-commercial portion of the crop since the commercial crop in the intermediate states is estimated at 18,432,000 bushels, or about 8 per cent below that of 1934.

On the basis of July 1 condition, the potato crop in the 30 late states is indicated at 295,000,000 bushels, compared with 312,000,000

in 1934 and a 5 year average of 290,000,000 bushels. Practically all of the reduction this year is in the eastern and central states, while the West shows a sharp increase The three eastern surplus producing states have prospects of only 89,000,000 bushels, against a very large production of 122,000,000 in 1934 and a 5 year average of 93,000,000 bushels. The five central surplus potato states had 96,000,000 bushels last year, but are expected to have only 91,000,000 this season. The 10 western late-potato states may increase from 54,000,000 in 1934 to a large crop of 74,000,000 bushels this year. The 12 other late states, which usually do not grow enough potatoes for their own needs, show only a slight gain over last year, and now expect about 42,000,000 bushels. Total United States potato acreage for harvest this year is estimated at 3,256,000 acres, or about 2 per cent less than last year but 2 per cent greater than the 1933 acreage.

Shipments by rail and boat during the first week of July decreased slightly to 3,225 cars of new potatoes and 225 cars of old stock. The season's total shipments (not counting movement by truck) of new stock to July 6 were about 33,000 cars, compared with nearly 45,000 at the same time last season. With lighter shipments than last summer from the Eastern Shore section and with New Jersey only beginning its movement, some advance in prices may be expected during the next few weeks, but the usual trend is downward until October or November, when marketing from the late states reaches a peak.

By June 15, the United States average farm price of potatoes had declined about 4 cents to 40.9 cents per bushel, ranging from a low of 11 cents in Maine to a high of $1.10 in Kansas. Growers in North Carolina and Virginia were averaging 70 to 75 per bushel. At the same time last season, the United States average was 64.4 cents, and the June average for 1910-1914 is 71.8 cents per bushel.

SECTIONAL NOTES

ARKANSAS

The potato marketing season which is practically closed was very satisfactory to growers and shippers during the early part of the season and very unsatisfactory during the latter part. In the southern part of the state yields were good and the crop was harvested and marketed in good condition and favorable prices were received. During the early part of the season, Triumphs consistently topped the terminal markets in competition with other

areas. Heavy rains causing extensive overflows in the Arkansas Valley ruined outright a large portion of the crop. The portion that was not overflowed was seriously damaged. Many potatoes were dug and marketed wet and dirty. This condition, together with hot weather, caused many heated and wet potatoes to be shipped, resulting in low prices for the portion of the crop which was shipped during the latter part of the season. (July 10).—J. H. Heckman.

CALIFORNIA

The crop in the Shafter District will probably be entirely marketed by July 20th. Shipments have been heavy and a wide outlet has been found

The crop in Los Angeles County will produce about normal.

The Stockton District gives every evidence of producing a light yield. However, it is too early to tell at the present time. We can be sure of one thing and that is that California will not add to any excess production in 1935 from now on. (July 10).—H. G. Zuckerman.

COLORADO

Weather conditions to date have been ideal for potatoes throughout the state. There was practically no moisture during June, but the heavy precipitation during May afforded favorable growing conditions. Most of the potato districts have a sufficient supply of irrigation water in storage, although there are a few sections which will be short of water for late irrigation unless there are some heavy showers during the next two months.

Very few psyllids have been found although serious flea beetle damage is now becoming apparent. Most of the growers who have the equipment are beginning to spray at this time as a preventive measure.

The outlook for the potato crop is the brightest at this time of the year since 1930. Field inspections for certification will begin shortly after the middle of the month. The acreage applied for this year is about the same as the acreage last year, with marked increases in two sections of the state on the western slope. Many old growers have not applied this year because they lost their seed stock through the drought last year, and are not financially able to secure new stock. (July 8).—C. H. Metzger.

INDIANA

During the past month the potato growers have been trying to get their crop in the ground between showers. The growers in the southern portion of the state will not plant potatoes until the latter part of this month,—mainly Cobblers. This will depend upon the amount of rainfall, as we find that quite a number of the farmers in the southern portion of the state are still trying to plant corn.

The early potatoes in southern Indiana look very good. The crop will be ready to harvest in the next week or so and the yields look very promising, nice quality and good size Cobblers that are clean. The small amount of potatoes produced in this state for commercial purposes will not interfere much with the commercial crop from other localities, but I believe our better quality potatoes will outsell those that are being shipped in unless they have been well graded. Water has damaged considerable portions of some fields of late potatoes in the northern part of the state. Several of the fields look very good and about the only thing that might interfere with a good crop of potatoes in northern Indiana will be the leafhopper. We find that most of the growers are getting into the field whenever possible to either spray or dust for the control of this pest. (July 8).—W. B. Ward.

KENTUCKY

Scattered lots of potatoes produced by commercial gardeners in the southern portions of the state began appearing on the market June 25, but the heavier movement from the "potato districts" St. Matthews, Worthington and Buechel, did not start until July 8. Prices started at $1.60 per cwt., but have since declined to $1.00-.90. The quality is exceptionally good, though there is some hollow heart. Yields are quite high, even with the potatoes still green. Feathering is quite considerable, but with careful handling not serious. (July 10).—John S. Gardner.

MAINE

Conditions in Aroostook have been more unfavorable than has been the case for the past ten years. The government estimate which was released July 10 reflects the situation accurately. On that same day late blight was discovered in the southern part and has since that time been found quite generally. The young plants

having grown rapidly during ten days of hot weather following two weeks of retarded growth, are very tender and readily susceptible to any disease. In addition, the soil has been very wet, preventing proper spraying protection. With the hot weather accompanied by showers, inability to spray, excessive soil moisture and tender plants, blight is very apt to spread rapidly. In any event, we know the crop production will be greatly curtailed.

Field inspection started July 15 for certification purposes. Indications now point to a much greater number of rejections than has been true for some time due to heavy aphis infestation last season, causing spread of virous diseases. Green Mountains have been affected more than any other variety.

Thousands of cars of potatoes of last season's crop are being dumped, most of them being spread on fields to be plowed this fall.

Maine growers are casting an anxious eye on Washington to learn of possible legislative developments in potato control. Apparently that will be their only salvation on a permanent program under present control systems for other crops. (July 12).—Frank W. Hussey.

MASSACHUSETTS

The official forecast as of July 1 for potato acreage in Massachusetts is set at about the same figure as last year, 16,000 acres. In the Connecticut Valley the acreage for 1934 was 4,017 acres as against 4,173 for 1935.

The weather has been ideal for potatoes and the crop is looking well with expectations of a good set. The very earliest-planted Cobblers are beginning to show signs of maturity and harvesting of these will undoubtedly take place in a few weeks.

A potato tour in the Connecticut Valley was held July 12 and a second tour in the southern part of the state July 13. Considerable interest among growers was manifest in demonstrations of single and double strength fertilizers and in comparisons on spraying with 5-5-50 and 6-3-50 formulas applied in both single and double applications. Growers are becoming convinced of the efficacy and economy through use of double strength fertilizers and their attention is being focused on the necessity for more thorough coverage of vines with spray to insure better control of leafhoppers and flea beetles. (July 13).—Ralph W. Donaldson.

MINNESOTA

Although it is rather early in the season to predict just what yield might be expected of a potato crop in Minnesota, it is quite evident that as far as the early section, or sand land area, is concerned, it is in much better shape than it was at the same time last year.

Last year, one grower in the Brooklyn Center area, just north of Minneapolis, irrigated seven acres of Bliss Triumph potatoes, using the overhead system of irrigation with the result that his irrigated field was the only profitable one in the entire section. This year, a considerable number of growers are irrigating, and, although the rainfall has been about normal to date, all the irrigating systems have been put to use whenever it appeared necessary. In general, the sand land fields look much better than they did a year ago, and the irrigated fields look especially well.

In the northern half of the state, potato planting was somewhat delayed this spring on account of cold weather, and reports indicate a rather uneven stand in some areas. However, rains have been timely, and growing conditions have been ideal during the past two weeks.

The total acreage of potatoes planted is about the same as last year. (July 9).—A. G. Tolaas.

NEW YORK

Unprecedented floods in Central and Southwestern New York have done tremendous damage to highways. No doubt potato fields have also suffered in many places. For example, the 4-acre field of potatoes in which the sample plots are planted at Ithaca has had two gullies washed through it about three feet wide and three feet deep. This will make it practically impossible to spray the field or to give it any further cultivation. In addition to this about 10 to 15 per cent of the plants were damaged by having the soil washed away from about the roots. Still others are wilting due to the waterlogged condition of the soil.

A recent inspection of the sample plots indicates that an unusually large number of fields will be disqualified this year on account of yellow dwarf, especially in the Smooth and Russet Rural varieties. The disease is still largely localized in the southwestern part of the State although it has been doing damage sporadically outside this area. Leaf roll and mosaic seem to have increased

about the same rate as usual. The acreage entered for certification has fallen off somewhat this year. The present prospects indicate that not more than two-thirds as much acreage will be certified this year as last year. (July 11).—K. H. Fernow.

In practically all the state, the potato crop is in better than normal condition. Many fields which were late planted in western New York have made slow growth because of subnormal temperatures during June. However, rainfall has been ample in most sections and the plants are now growing rapidly. This is the first time in several years that western New York has had sufficient rainfall. On July 8 and 9 the potato areas in Steuben, Yates, Chemung, Tompkins, Tioga, Cortland and Broome Counties experienced floods which eroded many fields, washed out hundreds of acres of crops and damaged highways which will require months to repair. Damage from high water was especially bad along the territory adjacent to the Chemung, Cohocton, Canisteo and Susquehanna Rivers.

The potato acreage planted on muck in western New York was again increased and except for the Montezuma area in Cayuga and Southern Wayne Counties which have been inundated by recent floods, the crop prospects are considerably above normal. (July 12).—E. V. Hardenburg.

LONG ISLAND

Hot dry weather during June and early July has been detrimental to the Long Island potato crop. Aphids are prevalent and leafhoppers are beginning to make their appearance. Some fields planted in Cobblers are practically dead. Rain yesterday will help to give the potato crop a new lease on life, but probably occurred too late to be of maximum benefit. The present outlook is for both a lighter Cobbler and Green Mountain crop than last year. A few acres have been dug and yields are reported to be below last year at this time. (July 10).—W. G. Been.

NORTH CAROLINA

The total shipment of early potatoes for North Carolina, as reported by the Federal Market Bureau, was 7,700 cars as against 10,700 cars for last season. In spite of this great reduction of shipments over last year, the prices did not go much above $2.00 per barrel and dropped sharply near the end of the season. Growers who shipped early and had a good crop made some money. Growers who had a small crop lost money, and most of the growers who shipped late lost money on the crop.

The growers of the late crop in the mountains report that they had good rains and a good growing season. They expect a good crop this year. (July 12).—ROBERT SCHMIDT.

NORTH DAKOTA

The entire State of North Dakota has had abundant rains prevailing all spring, and continuing throughout the early part of July. Good yields for our potato crop are therefore assured.

The acreage for both certified seed and common potatoes has not increased this year, so far as we can tell at present. We will likely have a larger volume of both kinds of potatoes to market, however, due to increased yields per acre.

We are not looking for any unusual appearance of diseases due to the moisture we have had this season. There is a possibility for black leg and other diseases effected by weather conditions, to show up, but we believe there will be very little difficulty. Our fields, both the top soil and sub soil, have been so dry due to the drought of the last several years, that the soil is taking up all of the moisture and is in good condition. (July 12.)—E. M. GILLIG.

OHIO

The prospect for early potatoes in Ohio is the best for several years. Rainfall has been ample and the weather has been cool. A few Cobblers are being dug along the Ohio River but digging will not be general for another week or two. The early digging will depend somewhat on the price.

The acreage of late potatoes will be somewhat smaller than a year ago. The late crop was planted later than usual, because of the wet weather.

The Legislature in Ohio passed a Bill to amend the seed law in the state. One section of this Bill protects the use of the word "certified" as used when applied to seed including potatoes. This will not affect the regular legally constituted inspection service in any of the states that are shipping seed into Ohio. This Bill states that when tubers are produced in another state, certification by the legally constituted officials of such state or country or of the United States shall be sufficient. The following information is required on the certification tag attached to each container: the grower's name and address or his number which shall be registered with the Director of Agriculture, and the name of the certifying agency and state of production. (July 11).—E. B. TUSSING.

PENNSYLVANIA

Inspections for seed potato certification have already started. Applications have been received from more than 60 growers in 18 counties. These growers have entered over 600 acres of potatoes for inspection and by the time the first inspection is completed we expect to have close to the same acreage entered as we had last year. There has been a slight increase in several of the counties and a decrease in the acreage entered in several of the southeastern counties.

Early planted fields seem to have come through with a good stand. Later planted fields are somewhat variable, some plantings showing good stands while others are quite poor and the plants less thrifty.

Flea beetles have done considerable damage to many of the Irish Cobbler fields. Cobblers had been suffering from drought up to a week ago when most fields received enough rain to mature them. (July 15).—K. W. Lauer.

SOUTH DAKOTA

Climatic conditions continue to be favorable for potato production. So far this season we have had an abundant supply of moisture in the eastern part of the state where most of our crop is produced. Temperature conditions have also been very moderate and favorable for the development of the crop. (July 6).—K. H. Klages.

TENNESSEE

Our earliest Irish potatoes were dug about June 15 to July 1, and most of the earliest crop has been sold. Midseason plantings on the higher elevations are now being dug or are ready to dig. The market seems to be well supplied, and some growers are delaying digging in the hopes of securing a better price. On the whole, we have had a fairly good season with an exceptionally cool spring. (July 11).—Brooks D. Drain.

VERMONT

Potatoes appear to be generally one to two weeks behind average development at this time, July 13th. Excessive rain during June, which retarded growth and delayed planting is largely the cause. Plants have grown rapidly during the past two weeks.

Preliminary checking of enrollments for certification indicate some acreage reduction from last year. It will probably total approximately 500 acres. Exceedingly low prices have discouraged

some growers from attempting to raise seed. (July 13).—H. L. Bailey.

WISCONSIN

Reports received at Madison from the leading potato growing areas of the state indicate that the crop is in excellent condition. Rains have been frequent and quite heavy. Some slight damage due to scald is reported from the recent hot weather following heavy rains. Temperature conditions have changed recently, however, to cooler weather.

Some slight damage is reported from rot in the heavier production sections, but this injury is scattering and is not considered serious. The flea beetle injury is conspicuous this year and we believe the damage from flea beetle is usually underestimated. The potato crop, however, has not received any serious set back this year and general conditions remain favorable.

Wisconsin growers are taking increased interest in the trial planting of new varieties scattered throughout the potato growing areas of the state. Seed stocks of leading standard varieties have also been brought in from other sections of the country. Four trial plots have been located under the direction of the Department of Horticulture in the state. A very comprehensive trial planting of the Katahdin and Chippewa has been made in Wisconsin this year. Several growers now have these varieties planted on a field scale after having grown small plots during the past two years. (July 9).—J. G. Milward.

Potato Meetings

July 31—Norristown, Penna. Montgomery County Potato Field Day.

August 8—Camillus, New York. Empire State Potato Club Field Day.

August 13—Randolf Center, Vermont. Vermont Certified Seed Growers' Association.

August 15—Wooster, Ohio. Potato Day, Experiment Station, Wooster, Ohio.

August 15—Avon, Colorado. Farmers' Field Day, Mountain Vegetable Sub-station.

September 12—Lake City, Michigan. Potato Field Day.

October 21—Wausaukee, Wisconsin. Annual Meeting and Show, Wisconsin Potato Growers' Association.

November 5-8—North Judson, Indiana. Sixth Annual Truck Crops Show.

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THE IMPORTANCE OF BETTER GRADING

Potato growers should give more attention to the proper grading of the crop. Each year a large number of potatoes are shipped which should never reach the market. In a recent bulletin from the Wisconsin Agricultural Experiment Station, H. H. Bakken reports that, during the shipping seasons from 1931 to 1934, 17 to 20 per cent of the potatoes were unusable or unacceptable to the consumers. "This big waste was expensive to assemble, transport and handle." He stated further that: "Dealers make allowances for these potatoes and pass them back to the producers by reducing the price that is paid for potatoes at local shipping points." Bakken suggests that government grades stamped on the tags and bags should be more extensively and rigidly applied. He reports that, "Every sample taken from bags bearing the U. S. No. 1 grade for the 1932 and 1933 crops exceeded the six per cent tolerance. There were no exceptions." These conditions do not exist only in Wisconsin—they are probably prevalent in all the important potato growing areas. Much has been said about the need for more careful grading of the potato crop but progress in the direction of a good pack has indeed been very slow.

There is little doubt that if the producers would keep off-grade potatoes at home, much good would result. This action would assist greatly in reducing surpluses in years of over-production. In this connection, Porter R. Taylor writes that, "it can be stated without possibility of contradiction that any surplus of production over demand can be entirely controlled by strict adherence to the U. S. No. 1 grade except in years of excessive production."

The Maine growers are attempting to improve their grades. Under the new branding law, which went into effect July 5, shippers of Maine potatoes are compelled to mark their potatoes as they really are. The Maine growers realize that if they are to compete with other areas they must put up a well-graded product. Growers everywhere must appreciate this fact. Careful attention to grading will go a long way toward improving conditions.